# Towards Instant Interaction Environment-
# A Handy Design Inspiration Object

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Abstract: Nowadays, digital design media have played very important roles in the design field. Designers carry on various stages of design through their assistances. However, those intermediaries should be regarded as not only pure operating practices, but assistances which aid the thinking of design concept with more intelligences and possibilities. Designers can be stimulated to break through the design fixation by the interaction between unconscious behavior (presses, rotates, moves and throws) and the R-B System, and by the feedback of sounds, lights, words and graphs.
Keywords: ubiquitous computing, tangible media, rethinking, interaction

## 1. INTRODUCTION

In the architectural design process, it is the latest tendency to use computers to help carrying on various stages of design. Designers use tangible media, such as mice, digital pens, digital boards, in the design process. Nevertheless, it is still very important for designers to have original design ideas. Many researchers also care about how effective the aids of computer work on designers' ideas and about the unexpected behaviors in the expected design process. In 1962, Asimow presented a design-process model that concerned with a vertical structure involving a sequential phasing of activities and a horizontal structure in the form of a decision-making cycle that is repetitious or iterative and exist in different phases of activities (Fig.1)[1]. Besides, Suls build a model of creative design based on an analogy with humour (Fig.2). This model inheres no particular process but provides a framework for computational processes capable of producing unexpected designs and of finding schemas which support them[2]. Therefore, computation could be enter in a objective view to estimate, discuss and analyze design.
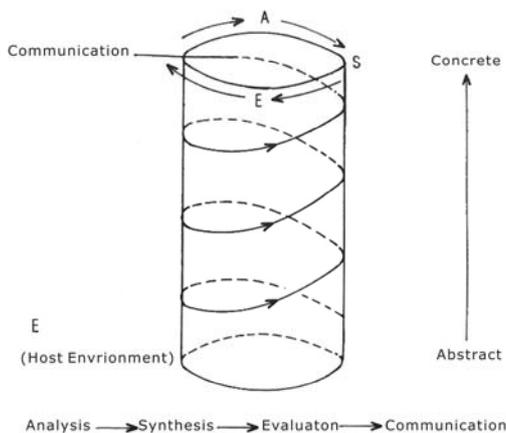


Fig. 1. An iconic model of a design process.
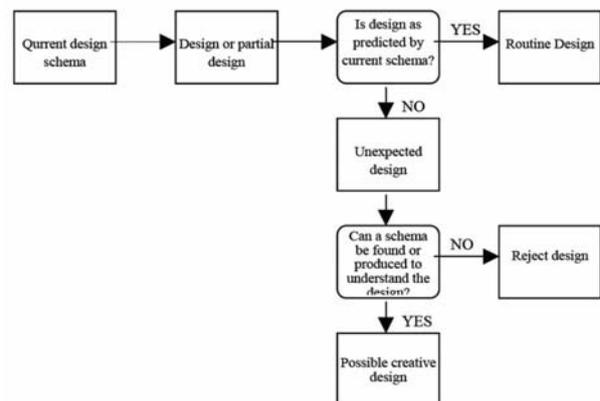


Fig. 2. A model of creative design based on an analogy with humour.

However, the relationship between the system of design aid and the phases of conceptual design has become closer nowadays. Thus, the systems that only afford designers multiple functions, rapid operation, and formidable memory space cannot satisfy designers' needs. Therefore, Langley, Simon, Bradshaw and Zytknow developed a kind of programming language, BACON, in 1987. They used heuristic Problem-Solving to be the guidance. For example, they used "if…than…" to be the principles of operation system in the computer[3]. Furthermore, Johnson-Laird (1988) developed Jazz Improvisation Program to make computer more heuristic to get more suitable information and possible results[4]. As a result, equipping the assist system of computer with intelligent logic rules, it is more probable to help designers think. In order to make computer more effective to help designers in the initial phase of originating ideas, many researchers stress the importance of physical input-device on designers' thinking[5, 6]. Stacy

believes that a successful computer-aid-conceptual-design (CACD) is a system that does not bound designers when they design and let them express their ideas naturally[7].

In 1991, Mark proposed the concept of Ubiquitous Computing. This concept permeates every aspect of human life without being known. Because those equipments are provided with basic ability of calculating, users can get information anytime and anywhere through the wireless Internet. As a result, design media can be inserted into the operating mechanism[8].

According to those opinions mentioned above and Mark's proposition about melting the concept of ubiquitous computing into the tangible media and the entrusting of intelligent logic, the initial structure that design media help designers working on conceptual design can be clearly seen.

## 2. PROBLEM AND OBJECTIVE

In the thinking process of conceptual design, designers would meet design fixation and cause the pause of design once in a while[9]. At that time, designers may, probably, fall in the design midnight. Thus, the designers must rethink about their whole design concepts, re-search possible data, or talk about related topics with others, etc. Facing this problem, designers can lessen the pressure that is brought by design fixation through the playful interaction with the aid of design media. Frequent interaction and communication between designers and tangible media can help designers go through the period of pause of design only if both sides are active in the interaction[10].

Whenever the designers have interaction with tangible media, their intention might cause design fixation. However, design fixation can be overcome through the stimulations of tangible media, such as vision and audition.

### 2.1 Problem

The main issue of this research lines in how to make the interaction between designers and tangible media（R-B system）more interesting. Besides, this research would also discuss some possible behaviors in this interaction and analyze which unconscious behaviors can be transformed more effectively to give feedback to designers and become the origin of designers' stimulation, especially when designers meet the design fixation.

### 2.2 Objective

The main purpose of this research is to construct a set of Rethinking-Ball System（R-BS）and feedback elements of perceptual to aid designers originate design ideas. Its device includes not only tools of input and output but also the system mechanism of interaction with designers.

## 3. RELATED WORK

### 3.1 Creativity in Conceptual Design

In the architectural design process, the initial phase of originating ideas is the main process of developing design creativity. However, every researcher has different opinions on the definition of design creativity. Sen believed that

creativity is the explanation of behaviorization. In this process, deep consideration and skillful craft can present people's creativity[11]. Rosenman and Gero proposed that creativity is a new way to re-combine the existent things producing new structures and new units. They also provided some ways to produce original works from an aspect of changing design prototypes, such as combination, mutation, analogy and principles of design (Fig.3)[12].
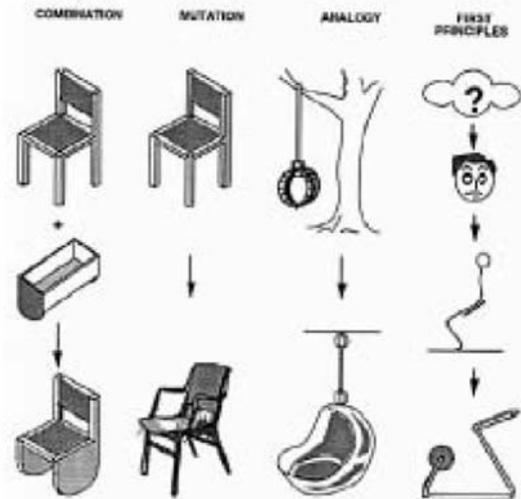


**Fig.3.** Demonstrations of the results of the procedures of combination, mutation, analogy and design from first principles, from Rosenman and Gero.

In the research of how media aid original design, Boden proposed that computer media, which provide formidable memory space and visual impact may encourage designer's creativity[13]. Besides, the creative thinking logic which designers use in computer media is different from that in traditional media[14].

### 3.2 Physical Computing in Conceptual Design

The design in aid of substantive media, Mckim believed, is a practice that designers embody their inner ideas through accessible design media in the conceiving phase of the design process. Nevertheless[15], Jeng presented cognitive space, physical space and simulation space to distinguish the situations of the interaction events that user controls the real interface to stir up interaction events, moreover, directly operate the digital data to generate the real and simulated human-centric-interaction mode.[5]

Regarding the interaction between designers and design media, Lim believes that some of designers' motives would be presented. Among these, the most occurring behavior when designers feel bored to think is to put down G pen.
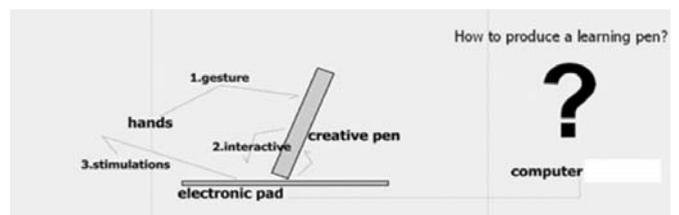


**Fig. 4.** G pen system concept.

This action reveals the thinking fixation in the design process. Other actions, such as playing with G pen, are behavioral features when drawing conceptual graphs. The roles of G pen for designers are not only tools of conceptual thinking but "design playmate" (Fig.4)[6].

As a result, this research believes that, in the thinking phase of design concept, the interaction between designers and tangible media can provide designers different ideas in the design process and can even aid designers' design concepts.

## 4. A SCENARIO EXAMPLE

In the following, we will simulate a simple scenario to explain the interaction between Rethinking-Ball（R-B）and designer:

Alan is an architect and recently received a resident design project. He used to hold R-B when start to consider the design project. After several sketches, he still hasn't getting any good idea and grasp the R-B harder and harder (initiate the system mechanism), the R-B started to play classical music. Hearing the music, Alan start to using the classical elements; after a while, Alan continue graphing on the sketch paper and unconsciously mistaken the R-B as a eraser, he trying to revise the sketch (initiate the system mechanism), the R-B started to glow that makes him direct his cogitation toward the combination of high tech and classic style. This scenario environment is to direct the designer to cogitate the design iteratively.
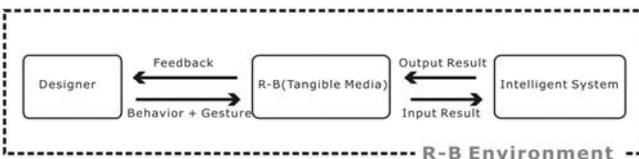
## 5. METHODOLOGY



**Fig. 5.** R-B system concept.

The R-B System in this research is a kind of interactive process (Fig.5). The design behaviors which happened between the R-B and the designers would give rapid reaction and feedback according to designers' different behaviors. The main design of this system is about designers' unconscious behaviors which are caused by the design fixation, such as pressing and throwing the ball, in the process of conceptual thinking. The detected data and message in the process would be analyzed and sent back to the designers. These feedbacks conclude voices, lights, vibration, words and simple graphs.



**Fig. 6.** Four actions in R-B system.

As a result, this research provides an initial system prototype. Since every designer has different design

behaviors on R-B, 10 architectural designers would be interviewed in this research and they would carry on the experiment of the R-B System. In the conceptual design process of the same housing project, the interactions between 10 designers and the R-B System would be recorded completely. According to this experiment, the results are as followed:

1. The 10 designers' four most occurring behaviors in the process of conceptual design (Fig.6).
2. According to the four concluded behaviors, the definition of interaction is divided into four major phases.
3. In the four major phases, the maximum arguments detected from every phase are the bases of behaviors.
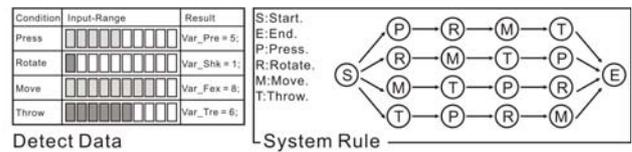4. Exclude the behaviors that might repeat and deduce four rules.



**Fig. 7.** Four rules in R-B system.

Making the four rules mentioned above to be the bases of systematic operation and judgment. Base on the four basic interactive situations to construct the feedback mechanism and rules of the R-B System (Fig.7).

## 6. IMPLEMENTATION

Observed from the process of interaction between designer's conceptual design and the R-B, the mechanism applying the technology of computer operation to detect data, dealing with message, deducing the meaning of designers' behavior, and giving feedback to the designers can help designers to break through the bottleneck. The R-B System includes two parts – hardware and software. There are six main elements in the hardware to carry on the construction of substance (Fig.8). The formula takes Java Script as the main programming language and writes in the analogue deductive mechanism, including data receiving, deduction and output.
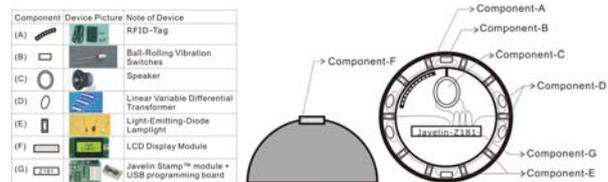
The R-B system is divided into 3 parts:



**Fig. 8.** The six components build R-B media.

1. Start the R-B System and ensure the identity of the user: In order to start the R-B System, it will need to ensure the user's identity through the RFID to connect to the Intelligent-Based System. Only when users work on the

R-B, the systematic mechanism of the R-B would be initiated and become the initial step for the system to read in data.

2. Operation of Rethink-Ball:

After initiating the systematic mechanism, the interaction of the R-B is divided into four actions, including Pressure, Rotate, Move and Throw. Being the basic operational behaviors, the R-B which behaves like what this research defined would read in data and send results to the program through Javelin Stamp (as the followed figure). After the judgment of the program, the R-B would be sent back and give feedback to the users.

3. Terminate and re-initiate the R-B System:

When designers terminate or stop the process of conceptual design, the R-B is put to the initial position. The system would record the whole process and annotate every feedback event. Thus, when the user wants to use the R-B system next time, in order to achieve the principle of unexpected events, there will not have the same feedback event.

## 7. CONCLUSION

The R-B System is an interactive design media. When designers meet design fixation, their thinking can be stimulated by the operation and feedback of the R-B System to initiates novel thinking or experience some accidental findings. Through Prototype Experiment, designers can have interaction and feedback with the R-B freely and naturally. The R-B System can possibly inspire designers more inspiration. At the same time, it also reveals the potency of design thinking which is applied by the interactive device of digital media.

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